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TREAT SEED GRAIN

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SEED-TREATMENT CHART

(Numbers refer to descriptions following)

Crops and diseases	*Seed treatment recommended*
Wheat (spring, winter, and durum):	
Stinking smut (bunt) and flag smut.	1, 2, 3, or 4.
Seed rots and seedling blights	1 or 2.
Loose smut	10.
Oats:	
Loose and covered smuts	1, 2, 9a, 9b, or 9c.
Seed rots and seedling blights	1 or 2.
Barley:	
Covered smut and black [1] loose smut.	1, 2, 9b, or 9c.
Stripe	1.
Seed rots and seedling blights	1 or 2.
Brown [1] loose smut	10.
Flax:	
Seed rots and seedling blights	1 or 2.
Corn:	
Seed rots and seedling blights	5, 6, 7, or 8.
Sorghums, including broomcorn:	
Kernel smuts, seed rots, and seedling blights.	1, 2, 3, 4, 5, 6, 7, or 8.
Rice:	
Seed rots and seedling blights	2, 5, 6, 7, or 8.

[1] Black loose smut is "shallow-borne" in the seed; brown loose smut is deep seated.

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TREATING seed grain is a standard recommended practice for the control of most seed-borne diseases. It prevents most smuts. It serves also to protect seed and young seedlings from soil-borne organisms that cause seed decay and seedling blights and to improve stand, yield, and quality. To treat all seed wheat, oats, barley, flax, corn, rice, and sorghum every year is good insurance. The seed should be thoroughly cleaned and then treated according to the following directions.

Before starting these treatments, be sure to read safety precautions, p. 12.

No. 1. NEW IMPROVED CERESAN DUST TREATMENT

(5 PERCENT ETHYL MERCURY PHOSPHATE)

(Applicable to spring, winter, and durum wheats, oats, barley, certain sorghums, and flax for the control of all the diseases of these grains listed on page 1, except certain loose smuts)

Apply New Improved Ceresan at the rate of one-half ounce per bushel (1½ ounces per bushel for flax) in a mixing machine (figs. 1 to 7), or as recommended in directions on the container. The treated grain should be kept uncovered in a bin, pile, wagon box, or sacks for at least 24 hours before seeding. Treated grain may then be seeded at once or stored. Ordinarily it should not be stored more than 4 weeks before seeding time, because of uncertainty as to the effect on seed germination after this period. This treatment has the advantage of being applicable to wheat, oats, barley, sorghum, and flax, is easily applied, does not cake in the drill, and is noncorrosive to drill parts. Do not apply more than one-half ounce of this disinfectant per bushel, except to flax. An excess may injure germination.

No. 2. CERESAN M DUST OR SLURRY TREATMENT

(7.7 PERCENT ETHYL MERCURY P-TOLUENE SULFONANILIDE)

(Applicable to spring, winter, and durum wheats, oats, barley, rye, flax, rice, and certain sorghums)

In dust form, apply at the same rates, in the same manner, and with the same precautions as described for New Improved Ceresan (treatment No. 1).

In slurry form (see p. 12), apply at rate of 1 pound per gallon of water to 32 bushels of wheat, rye, rice, and sorghum; 1½ pounds per gallon to 32 bushels of oats or barley; and about 3 pounds per gallon to 32 bushels of flax. Apply in a specially constructed slurry treater, as shown in figure 6 and referred to on page 12.

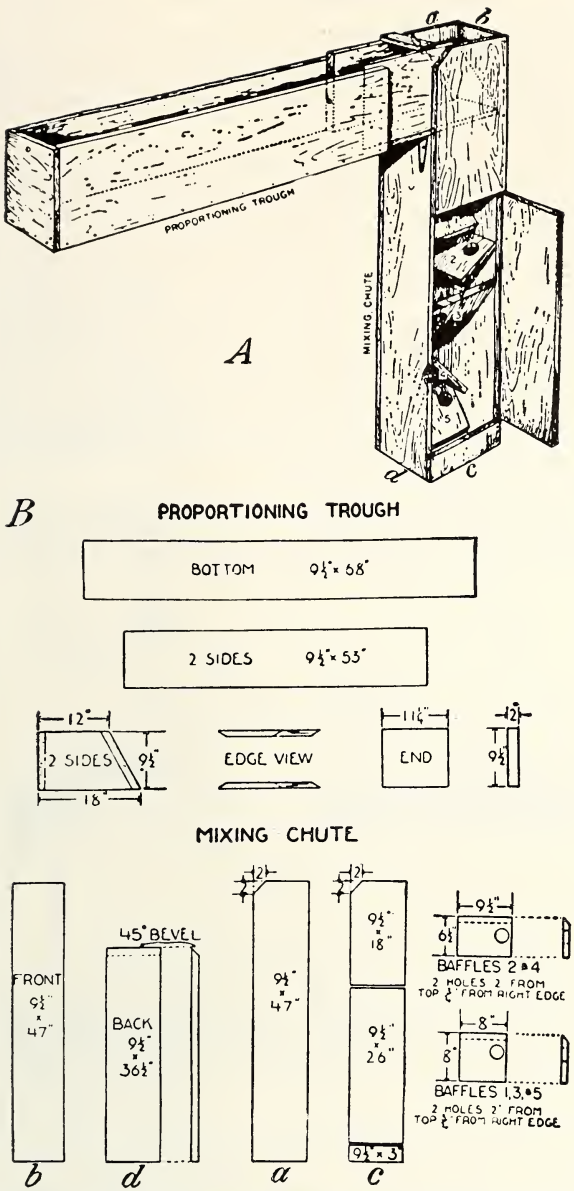

FIGURE 1.—Minnesota seed-grain treater for applying mercury dust fungicides (treatments Nos. 1 and 2). Not suitable for applying copper dusts, Arasan, Spergon, or Phygon. *A*, Construction of horizontal proportioning trough and general view, showing arrangement of baffles in vertical mixing chute. *B*, Parts for making the treater. (Courtesy of the Minnesota Agricultural Experiment Station.)

No. 3. COPPER CARBONATE DUST TREATMENT

(Applicable to spring, winter, and durum wheats for the control of stinking smut and flag smut and to sorghums for the control of kernel smuts, seed rots, and seedling blights. Not applicable to oats, barley, flax, rice, or corn)

Use a full-strength copper carbonate dust (about 50 percent copper), manufactured especially for seed treatment. Apply to well-cleaned seed, at the rate of 2 to 2½ ounces per bushel. Mix the seed and the dust in a tight mixing machine (figs. 4, 5, and 7) until every kernel is thoroughly covered with the dust. Seed thus treated may be stored indefinitely until sown, without injury to germination. With this chemical, care must be used to avoid damage to the grain drill. In damp or wet weather there is sometimes a tendency for the treated seed to cake in the drill when standing overnight or longer. In such cases it is advisable to rock the drill wheels back and forth before starting, in order to avoid breaking or bending the working parts. All working parts should be kept well oiled. To avoid corrosion, the drill should be well cleaned out when seeding is completed.

Diluted copper carbonate dusts (about 20 percent copper), manufactured especially for seed treatment, if used at the rate of 3 ounces per bushel, usually are as effective as the full-strength (50 percent) dust.

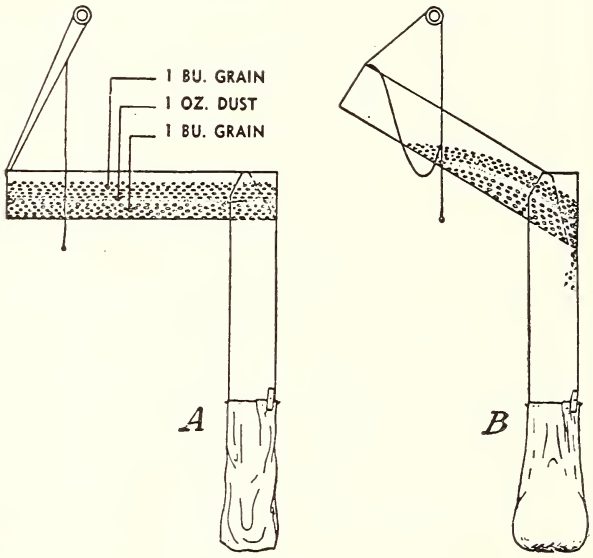

FIGURE 2.—Using the Minnesota treater. *A*, Seed and mercury dust are spread in horizontal proportioning trough as shown. (One ounce of dust for 2 bushels is satisfactory for wheat, oats, barley, and sorghum, but 3 ounces for 2 bushels should be used for flax.) *B*, Seed and dust are dumped into and run through vertical mixing chute. (Courtesy of the Minnesota Agricultural Experiment Station.)

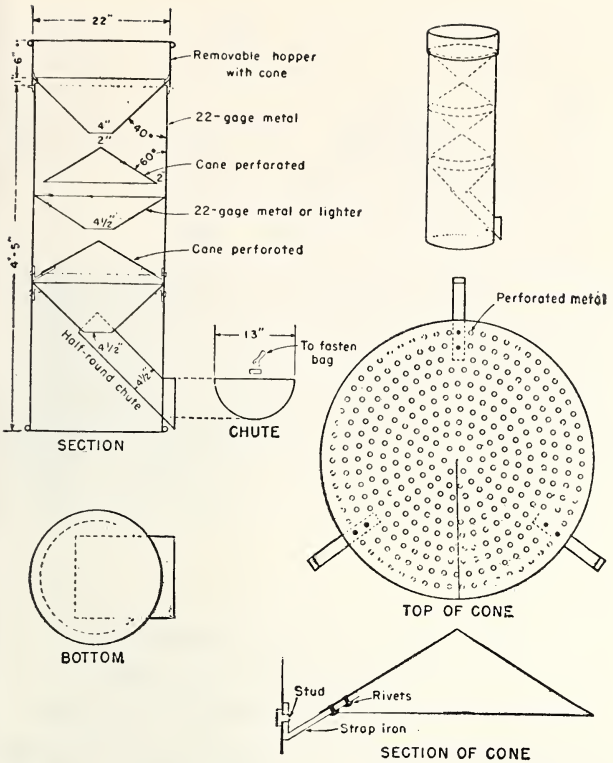

FIGURE 3.—Construction of a gravity-type treater for applying the mercury and dust fungicides (treatments Nos. 1 and 2). Not suitable for copper dusts, Arasan, Phygon, or Spergon. Capacity up to 200 bushels an hour. (Courtesy of the Iowa State College Extension Service.) For safe and more effective dust mask, see figure 8.

No. 4. BASIC COPPER SULFATE TREATMENT

(Applicable to spring, winter, and durum wheats for the control of stinking smut and flag smut and to sorghums for the control of kernel smuts, seed rots, and seedling blights. Not applicable to oats, barley, flax, rice, or corn)

Use full-strength basic copper sulfate dust (about 50 percent copper), manufactured especially for seed treatment or orchard dusting. Apply at the rate of 2 ounces per bushel of cleaned seed in the same way and with the same precautions as described for copper carbonate.

No. 5. ARASAN DUST TREATMENT

(50 PERCENT TETRAMETHYL THIURAMDISULFIDE)

(Applicable to corn, sorghums, and rice only)

Apply Arasan dust at the rate of 1½ to 2 ounces per bushel. Mix seed and dust thoroughly, preferably in a rotary mixing machine (figs. 4, 5, and 7), until the seed is evenly coated.

No. 6. ARASAN S. F. SLURRY TREATMENT

(75 PERCENT TETRAMETHYL THIURAMDISULFIDE)

(Applicable to corn, sorghums, and rice)

Apply at rate of 1 pound of Arasan S. F. per gallon of water to 30 bushels of corn; 1½ pounds per gallon of water to 30 bushels of sweet corn or sorghums; and 2½ pounds per gallon of water to 30 bushels of rice. Apply in specially constructed slurry treater, such as shown in figure 6 and referred to on page 12.

No. 7. SPERGON DUST TREATMENT

(TETRACHLORO-PARA-BENZOQUINONE)

(Applicable chiefly to corn, sorghums, and rice)

Apply Spergon dust at the same rate and in the same way as described for Arasan dust treatment (No. 5).

No. 8. PHYGON DUST OR SLURRY TREATMENT

(50 PERCENT DICHLORO-NAPHTHOQUINONE)

(Applicable chiefly to corn, rice, and sorghums)

In dust form, apply Phygon at the rate of one-half ounce per bushel to corn and at the rate of 1 ounce per bushel to rice and sorghum. Mix seed and dust thoroughly in an effective mixing machine (figs. 4, 5, and 7) until the seed is evenly coated.

For the slurry method of application (p. 12), mix 1 pound of Phygon in 1 gallon of water. This is sufficient to treat 32 bushels of corn or 16 bushels of rice or sorghum. Apply in a specially constructed slurry treater, such as shown in figure 6 and referred to on page 12.

FIGURE 4.—Oil-drum mixer for applying any of the dust disinfectants. Capacity 20 to 30 bushels an hour. (Designed by R. S. Kirby, Pennsylvania State College.) For safer and more effective dust mask, see figure 8.

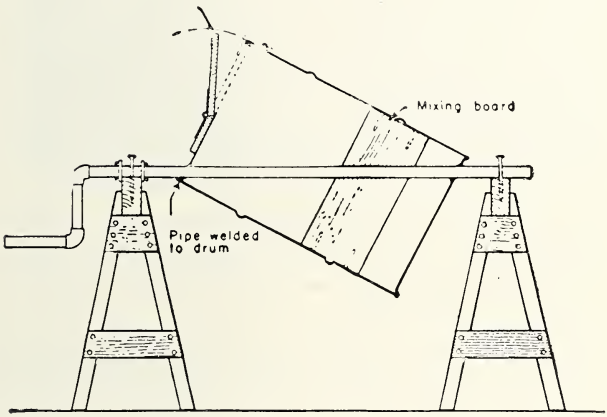

FIGURE 5.—Construction of oil-drum mixer, with mixing board and pipe welded to ends of drum. (Designed by R. S. Kirby, Pennsylvania State College.)

No. 9a. FORMALDEHYDE SPRAY TREATMENT (DRY)

(Applicable only to oats for smut control)

Mix 1 pint of commercial formaldehyde with 1 pint of water. Apply uniformly with a sprayer at the rate of 1 quart of the mixture to 50 bushels of seed as it is leaving the grain spout or is being shoveled from one pile to another on a clean floor or canvas or in a tight wagon box. Bin it or pile and cover with canvas, blankets, or disinfected sacks for 4 to 8 hours. Then sow immediately or run through fanning mill or otherwise expose to air before storing for any length of time. If treated grain is stored in an elevator it should be moved and aerated, preferably by running through a fanning mill, within 4 to 8 hours after treatment. This is a convenient method for treating large quantities of seed oats rapidly.

No. 9b. FORMALDEHYDE SPRINKLE TREATMENT (WET)

(Applicable to oats and barley for the control of certain smuts. Does not control barley stripe)

Mix 1 pint of commercial formaldehyde with 10, 20, 30, or 40 gallons of water at a temperature of 60° to 70° F., and, with a sprinkling can, sprinkle the solution uniformly on 50 bushels of seed grain as it is being shoveled from one pile to another on a clean floor or canvas or in a tight wagon box. Shovel until all the seed is uniformly moist. Pile and cover with canvas, blankets, or disinfected sacks for at least 4 hours, or overnight. Then sow immediately. If the sowing must be delayed, spread out the treated seed to dry and sow as soon as possible. This treatment sometimes injures germination to some extent, particularly when seed is held for some time after treatment or when it is sown in dry soil. Treated seed should not be allowed to freeze while it is damp or wet. If grain is moist, increase the seeding rate about one-fourth.

No. 9c. FORMALDEHYDE DIP TREATMENT (WET)

(Applicable to spring wheat, durum wheat, oats, and barley for the control of certain smuts. Does not control barley stripe)

Mix 1 pint of commercial formaldehyde with 40 gallons of water in a barrel or tank. For best results the temperature of the water should be about 60° to 70° F. Dip loosely filled burlap sacks in this solution until the grain is thoroughly wet. Drain and dry 2 hours, or overnight. Then sow immediately. If the sowing must be delayed, spread out the treated seed to dry and sow as soon as possible. Formaldehyde-treated oats may be held longer than similarly treated wheat without injuring germination. This treatment sometimes injures germination to some extent, particularly in the case of wheat when held for

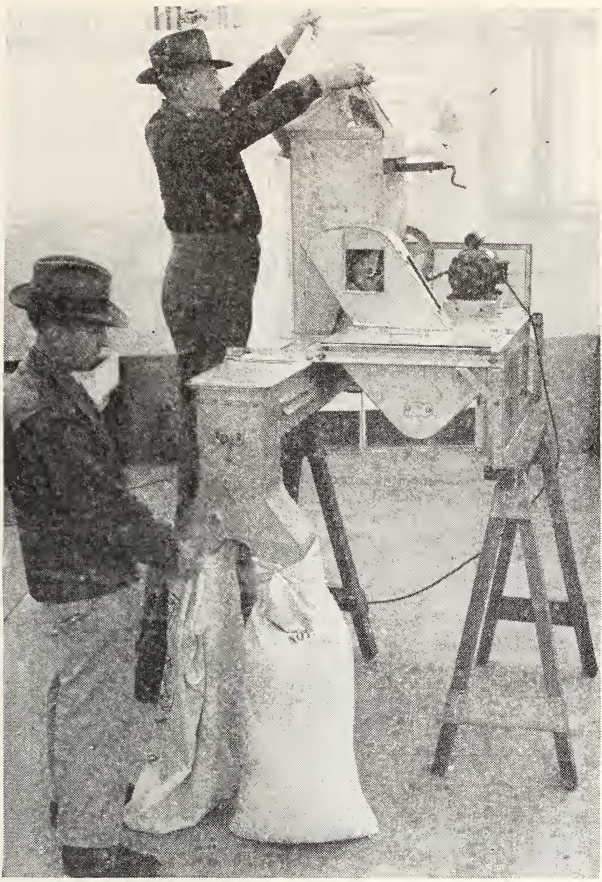

FIGURE 6.—Small-size treater designed especially for treating seed by the slurry method. In large-scale installations, grain is delivered to hopper by chute. Detailed instructions for operating machines such as this and larger ones are supplied by the manufacturers of the treaters and of the seed disinfectants to be used in them.

some time after treatment or when sown in dry soil. Treated seed should not be allowed to freeze while it is damp or wet. If grain is moist, increase the seeding rate about one-fourth.

No. 10. HOT-WATER TREATMENT

(Applicable only to wheat and barley for the control of loose smuts)

Loose smut of wheat and brown loose smut of barley can be controlled only by the hot-water treatment. This treatment requires great care and also special equipment

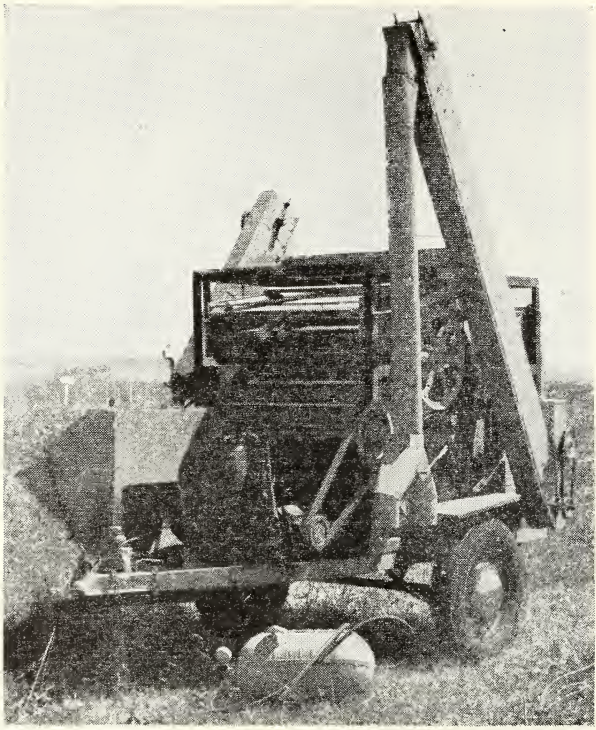

FIGURE 7.—Portable seed-cleaning and treating equipment mounted on a trailer. (Courtesy of C. E. Skiver, director, Kansas Wheat Improvement Association.)

usually not found on farms. The minimum equipment required consists of a source of steam or other means for heating water and keeping it at an even temperature, an accurate thermometer, and several tubs, barrels, or tanks, each large enough to hold a bushel or more of seed. The equipment used varies according to what is available. There are four stages in the hot-water treatment, as follows:

1. Place about one-half bushel of seed in a loosely woven bushel sack, tie at the top, and soak in unheated water for 4 to 6 hours.
2. Temper the seed by soaking it for 1 to 2 minutes in water at about 120° F.
3. The critical treatment:
   For *barley*, soak the tempered seed for *exactly 13 minutes* in water held at *exactly 126° F.;* and for *wheat, exactly 10 minutes* at *exactly 129°*.
4. Quickly spread out the treated grain in a thin layer on a clean floor or canvas to dry thoroughly before sowing.

For more complete details of this treatment, write to the State agricultural college or to the United States Department of Agriculture.

Wheat or barley from fields heavily infected with the loose smuts mentioned above should not be used for seed unless first subjected to the hot-water treatment. It may be more convenient to obtain elsewhere seed that is free from loose smut or resistant to it. Frequently, because of the difficulty of the hot-water treatment, only a relatively small quantity of seed is treated. This treated seed is then sown in an isolated field to furnish smut-free seed for the following year.

TREATING EQUIPMENT

Equipment for applying fungicidal dusts to seed grain ranges from home-made hand mixers operating at the rate of 25 to 30 bushels an hour to commercial, automatic, power-driven, and gravity-type mixers handling 200 to 500 bushels an hour.

FIGURE 8.—A good type of dust mask (respirator). To avoid inhaling dusts face masks of this or similar types should be worn by persons working for long periods with dust disinfectants. Follow directions of manufacturers.

On small farms, a rotating mixing drum (figs. 4 and 5), box, or barrel is satisfactory for applying Arasan, Spergon, or copper dusts. For applying mercury dusts, these or one of the gravity-type treaters (figs. 1 to 3) may be used. On large farms, one of the commercial or home-made treaters of larger capacity may be better.

The slurry method of seed treatment has been devised to overcome the discomfort and health hazard caused by chemical dusts flying in the air. The fungicidal dust is applied as a water suspension, or slurry, of about the consistency of buttermilk. This method requires a specially constructed slurry treater, a number of which are on the market (fig. 6). As these treaters are rather expensive, the slurry method of seed treatment usually is confined to seed houses, elevators, or community treating centers where large quantities of seed are treated. Detailed directions for treating by this method are given by the manufacturers of the treaters and also by the makers of the fungicides to be used.

Large-scale seed treatment by local elevators, seed houses, central treating plants, or portable treating outfits (fig. 7) is practicable and valuable and is increasing in popularity. This kind of custom service is of great convenience to farmers, particularly when farm labor is scarce. Farmers who hire someone to treat their seed for them, however, should make sure that the proper chemicals are used and that they are applied at the recommended rates per bushel.

Treating seed is much easier now than it was several years ago. New materials, methods, and equipment make it possible to treat seed rapidly and effectively and at low cost.

For further information consult your county agent or write your State extension service or the United States Department of Agriculture.

CAUTION.—Seed-treating dusts are poisonous, and formaldehyde fumes are irritating.

Avoid inhaling dusts or fumes from any seed disinfectant.

Treat seed in a well-ventilated place or outdoors.

Wear a good dust mask over the nose and mouth (fig. 8). Change filters daily.

Avoid accumulation of mercury dusts on moist skin, as some are highly irritating or even may burn or blister the skin.

Wash frequently and keep the skin dry.

Seed treated with any of the dusts should not be fed to farm animals or used for food for human beings.

Containers used for treated seed should be thoroughly cleaned before being used for any other purpose.

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NOTE.—This revised publication supersedes Miscellaneous Publication 330, the Minnesota Seed-Grain Treater, issued in 1938.

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